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DOUGLAS PRICE MEMORIAL LECTURE, No. 3

THE ANCESTRY OF MAN

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BY

F. WOOD JONES,

Professor of Anatomy in the University
of Adelaide.

Wholly set up and printed in Australia.

~~Registered by the Postmaster-General for transmission through the post as a book.~~

Printed for the Trustees.

R. G. GILLIES & CO LTD.,

149 Elizabeth Street, Brisbane.

1923.

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INTRODUCTION.

The third Douglas Price Memorial Lecture was delivered in the Albert Hall, Brisbane, on Thursday, 23rd November, 1922, before a large audience. His Excellency the Governor, Sir Matthew Nathan, presided, and introduced the lecturer. A vote of thanks to Professor Wood Jones was proposed by Mr. H. A. Longman, seconded by Mr. A. Ralston, supported by the chairman, and carried with enthusiasm. On the motion of Mr. T. L. Jones, chairman of the trustees, His Excellency was thanked for presiding.

To ensure a continuance of these lectures, the trustees of the fund will welcome further subscriptions from sympathisers. Contributions may be forwarded to the Hon. Treasurer, Mr. A. Ralston, Box 301, G.P.O., Brisbane.

The Trustees of the fund are as follows:—Mrs. H. White, Mr. T. L. Jones, Rev. Geo. Neal, and Messrs. H. W. Jenkins, Heber A. Longman, and A. Ralston.

Copies of the first Douglas Price Memorial Lecture, "The Place of Ethics and Religion in Education," by Professor Meredith Atkinson, M.A., may be obtained through booksellers, or on application to Mr. A. Ralston, Box 301, G.P.O., Brisbane. Cloth, two shillings; paper, one shilling.

Copies of the second lecture, "Psychology and Religion," by Professor Elton Mayo, may be similarly obtained for one shilling and six pence.

CHAIRMAN'S ADDRESS.

By His Excellency the Governor, Sir Matthew Nathan, G.C.M.G.

Douglas Price, in whose honour the lecture this evening is to be delivered, attempted, I understand, by the bridge of his keen and honest intelligence, to connect the truths of science and criticism with his old faiths, restated according to these truths. The world, for its advancement, depends largely on its bridge-builders—on those whose natural inclination it is to throw a communication across a chasm, to link up creeds and parties, theories and periods. The character and the power of the bridge-builders in whatever sphere they may operate has always seemed to me admirable, and a slight historical sense, of great assistance in the enjoyment of life, has also interested me in the constantly narrowing chasm between history and pre-history. It is intensely attractive to watch the historians throw back the story of man until Sargon, of Accad, and Mena, of Egypt, are passing from the dawn to the mid-day of civilisation, and at the same time to see the anthropologists, by their investigations, throw it forward, connecting old forms of the human species with the men grown nearly historical, who drew their pictures on the rock of the cave and the bone of the reindeer. Then, just as there is this chasm between his historic descendants and prehistoric man, so is there one between him and his mammal ancestors. It is for this chasm that Professor Wood-Jones will this evening show us in outline the drawing of the bridge he has designed. His complete training in and practice of Anatomy, Anthropology, and even Archaeology, have fitted him to make such a design, and in confidence that he will present to us a clear and attractive picture, we ask him now to give the third Douglas Price Memorial Lecture.

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THE ANCESTRY OF MAN:

MAN'S PLACE AMONG THE PRIMATES.

FOREWORD.

On February 27th, 1918, it fell to my lot to deliver a lecture at King's College, London. This lecture was intended for the general public. The subject of it was "The Origin of Man."

The thesis then put forward was that the general notion that Man had evolved along the line of the Linnean Classification was wrong. Far from the Lemurs, the Monkeys, and the Anthropoid Apes being landmarks upon the line of human progress, it was contended that the human stock arose from a Tarsioid form, that the Lemurs were not ancestors of the Tarsioids and that the Monkeys and Apes were more specialised away from the Tarsioids than was Man himself, and, therefore, were not his ancestors, but rather his collateral descendants from a former assemblage of animals, of which we have only one direct living descendant, in the form of *Tarsius spectrum*.

In the interval of four years two lines of criticism have been levelled against my presentation of this thesis: the one, that it was all well known long ago, and was, therefore, not worth repeating; the other, that it was entirely wrong.

Criticisms of the second class may be found in the following publications:—

(1) Proc. Zool. Soc., Lond., 1919, published Feb., 1920. "Discussions on the Zoological Position and Affinities of Tarsius," pp. 465-498, contributions by Professors G. Elliott Smith and J. P. Hill, etc.

(2) Amer. Jour. Phys. Anthropol., Vol. iii., pp. 213-245, 1920. Gerrit S. Miller, "Conflicting Views on the Problem of Man's Ancestry."

(3) Mem. Amer. Mus. Nat. Hist. (N.S.), iii. (part II.), pp. 51-243, 1920. W. K. Gregory, "On the Structure and Relations of Notharctus, an American Eocene Primate."

(4) Jour. Dental Research, Vol. ii., Nos. 1, 2, 3, 4, 1920; Vol. iii., No. 1, 1921. "The Origin and Evolution of the Human Dentition. Reprinted. W. K. Gregory, 1921.

Since all these publications contain destructive criticisms of my original thesis, I have thought it well to restate all my contentions in the light of the accumulated adverse criticism. In order to do this I have laid each contribution under toll, and have gathered from each those definite conclusions which, urged against my thesis, seem to me to help towards its final acceptance.

I have ascended the same ladder of argument as I ascended in 1918 but now, thanks to an interval of four years, the rounds of the ladder are largely built of the assertions of my critics. This is my excuse for the large number of quotations from, and criticism of the work of others.

To read a written lecture is a simple matter. To write down, with any justice, a lecture which had no more substance than a sequence of ideas at the time of its delivery is a far more difficult business.

I imagine that, despite the unattractive literary style which such a method must of necessity produce, it is most just to put a lecture into a written form as nearly as possible resembling the actual sequence, and the actual form, of the statements made during the course of delivery.

Simple though this proposition may appear, it has by no means always been respected in discussions on the Origin of Man; for there have been cases where the written accounts of contributions to debate have varied very widely from the sentiments actually voiced at the time of discussion.

It will readily be admitted that if we are to enquire into the ancestry of Man we will do well to be guided by the same general principles as guide us in attempting to determine the phylogeny of any other animal. If there are certain principles which must be regarded in coming to a conclusion concerning the descent of a marsupial, these same general principles must not be disregarded in a discussion of the origin of Man. A thorough examination of the structure of any animal will reveal the fact that the anatomical details of which its body is compounded are the outcome of two factors; the anatomical form of the individual is the resultant of ancestral inheritance, combined with the effects of adaptation to the life circumstances of the animal. In the nomenclature of American paleontologists: *An animal, regarded from the point of view of structure, is a complex of the basal plans of heritage and the adaptations of habitus.* It should always be our endeavour to sort out these two factors in the make-up of an animal, and herein lies the greatest interest in the investigations of modern comparative anatomy.

At one time, great merit was supposed to attach to the mere compilation and comparison of tables of anatomical characters, and investigations conducted on these lines have had an almost unbroken sequence from the time of the publication of Edward Tyson's "Anatomy of a Pygmie," in 1699* to the present day. The method may best be illustrated from Tyson's own work:—

Forty-eight details of structure in the anatomy of the Chimpanzee were found by him to be more like the corresponding parts of Man than those of a Monkey. Fifty-seven details were found to be more akin to the type prevailing in a Monkey than to that characteristic of human anatomy.

Now, these different structural details had, of necessity, very varying values; some were important, some trivial, some, maybe, were the products of heritage, some the products of habitus. It requires no great erudition to realise how fallacious such a method may prove. A pig, we may say, resembles a table more than it does a bird in the character that it possesses four legs. Obviously, there must be some rigid method of assessing the value of the characters employed in such a comparison.

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*Edward Tyson, The Anatomy of a Pygmie, etc., London, 1699, p.p 92-95.

Since similar habits produce similar modifications in creatures derived from different stocks, it is quite possible for the structural details, modified by habitus, to become singularly alike in creatures of widely different heritage. This is the phenomenon known as *Convergence.* It is by convergent development, apart altogether from kinship, that the ornithodelphian, "Porcupine" (*Echidna*) comes, in some rough general respects, to resemble the true monodelphian, Porcupines (*hystricomorphine Rodents*), and the Hedgehogs (*erinaceine Insectivores*). Now, even if two animals of different heritage become convergently modified by similar habitus, we shall find, upon careful examination that, though a hundred structural similarities may be found to unite them, some fundamental structural character, due to heritage, severs them utterly. *One fundamental structural difference begot of heritage outweighs many structural resemblances begot of habitus*

It is, therefore, clear that Tyson's method, even in its most up-to-date refinements, is an insufficient weapon with which to attack any problem of animal phylogeny. It is necessary to recognise the fundamental structural features due to heritage; it is necessary to assess the structural characters due to habitus and it is important to attempt to assign the proper causal factor to these last characters.

The failure to detect fundamental structural characters has led Lucas and Le Souef to make the remarkable, and absolutely incorrect, statement that, "There is not a hard and fast definition"† by which the Marsupials (*Didelphia*) may be separated from the higher Mammals (*Monodelphia*). This instance has been selected solely for the reason that the publication is a comparatively recent one; but we have only to glance at some of the schemes of zoological classification put forward from time to time to realise that the importance of fundamental structural characters has not always been appreciated, or even recognised, by the taxonomist. Again, the failure to assign the proper causal factor to modifications due to habitus has produced many curiosities of scientific literature. As a recent example we may note that Dr. W. K. Gregory, in discussing the curious procumbent front teeth of the Lemurs, concludes that the profound change "has been conditioned in part by the enlargement of the tongue in adaption to frugivorous habits."* The evidence upon which Dr. Gregory relies in support of this strange hypothesis is that "dissection of a lemur shows that all the lower and side teeth are pressed forward and outward by the greatly enlarged tongue." In this particular Dr. Gregory has altogether overlooked the true functional factor, and his speculations, thereby, lose part of their value. In 1829, Frédéric Cuvier, when describing the common *Lemur catta*, stated that: "Ces animaux sont portés, par leur instinct, à se gratter mutuellement avec ces dents, qui semblent ne leur avoir été donnés que pour nettoyer leur pelage; car ils ne s'en servent jamais ni pour mordre, ni pour couper; ce sont de véritables peignes."† In 1918 the present writer again, and independently, pointed out the hair-comb functions of these teeth, and of the lemurine sub-lingua, and noted the convergent, but dissimilar, development of the lower incisors of *Galeopithecus.*

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† The Animals of Australia, 1909, p. 3.

* On the Structure and relations of Notharctus. Mem. Amer. Mus Nat. Hist. N.S. Vol. III., Part II., 1920, p. 203.

This example, like the previous one, has been taken merely because of its recent publication; but the field for the selection of examples is very wide, and those interested in questions of this kind will recall the instances of the syndactylous digits of certain marsupials, the flattened tail of the beaver, the lower incisors of the Australian water-rat (*Hydromys*), and dozens of other structural modifications for the causation of which purely imaginary and ridiculous factors of habit have been solemnly advanced.

Although fundamental structural characters have been spoken of as though they were always very obvious features, and although those who have failed to find them in certain cases have been criticised, nevertheless, it must be confessed that they are by no means always striking, gross, or particularly obtrusive characters. The qualification to rank as a fundamental structural character begot of heritage is not necessarily the apparent magnitude, or the patent nature, of the character. An apparently very trivial, and inconspicuous, anatomical feature may totally sunder two animal types, which, in general body build, are strikingly similar.

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† Geoffroy Saint-Hilaire et F. Cuvier. Historie naturelle des Mammiferes, p. 218.

¶ Jour. Anat. Vol. LII., 1918, pp. 345-354.

Although it may not be very easy to give a precise and satisfactory definition of a fundamental structural feature begot of heritage, it is a simple matter to appreciate its nature by studying an example.

There is no grander manifestation of the phenomenon of Convergence to be witnessed than that displayed by the striking general likeness between certain marsupials and certain higher mammals. A Marsupial Mole (*Notoryctes*) is remarkably like the true Moles; *Phascogale penicillata* is singularly reminiscent of a Tree Shrew (*Tupia*), and the list could be extended to weariness. A Marsupial is often said to be an animal which has a pouch, which has the angle of the lower jaw inflected, the palate perforated by a series of vacuities, and the commissures of the brain incomplete. But there are certain Marsupials which are pouchless, some in which the palate is quite complete, and the lower jaw not inflected at its angle, and but little to choose between their cerebral commissures and those of the lower Monodelphia. If such forms resemble, in a convergent way, types familiar in the Monodelphia, the totality of likeness may be so great that the animals seem to be closely akin. Nevertheless there is one basic feature of heritage which sunders all Didelphia from all Monodelphia: for in the first group the ducts of the kidneys (ureters) pass between the oviducts, and, in the second, the oviducts pass between the ureters.

Now this is a particularly instructive case. The difference in the disposition of the ducts of the kidneys and the ducts of the ovaries, displayed in the two groups, is fundamental; it is ontogenetically very early in its inception; it is phylogenetically early in its development. Judging by this feature alone, we can be certain that the higher animals were not derived form the marsupials, and that the marsupials were not derived from the higher animals. We can be sure that Ernst Haeckel's easy assumption that the higher animals are " a further development of the Metatheria"* is one that facts do not justify. We may, in fact, be confident that both stocks were derived from a far back common stem, in which the kidney ducts and the oviducts had some such disposition as is seen in existing Reptiles, and in the present-day Monotremes. From the basal type the two stocks diverged; the marsupials typified by the kidney buds growing backwards medial to the oviducts, the higher mammals by the kidney buds growing backwards lateral to the oviducts.

The general structural features of the Didelphia and Monodelphia may become so strikingly alike as to have prompted Lucas and Le Souef to declare that no hard and fast definition could separate them. Yet always there is that strange single character of unlikeness amidst a hundred characters of general likeness.

No matter if a host of witnesses attest to similarity, and claim for kinship—the position of the ureters, trivial though it may seem, denotes the great difference of heritage.

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* The Last Link, London, 1898, p. 67.

In this particular case we have selected a fundamental anatomical feature that definitely sunders two groups; and in each of the groups thus separated there are primitive types and specialised types. The primitive types of the two series are strikingly like each other; the specialised types of the two series either diverge from each other, or they converge towards each other as habitus dictates. Here, then, we can trace, with some assurance and by means of an apparently minor character, two mammalian stocks back to some very far distant point of divergence. We can be sure that there was no end-on evolution from marsupials to higher mammals, but that both arose and diverged from some singularly primitive and remote ancestor.

Let us take another example. The horse and the cow, in some respects, resemble each other. The resemblance may not be very close, but all will admit that a cow is more like a horse than it is like a bat.

The fact that the horse and the cow share several anatomical characters in common has led zoologists to class them both in the order Ungulata. Within this Order the horse typifies the Perissodactyla, and the cow typifies the Artiodactyla, but there are Artiodactyles considerably more like Perissodactyles than the cow is like the horse.

In general architecture, omitting the presence of horns, the skull of a cow and the skull of a horse are somewhat alike; they are sufficiently alike for their identification to be by no means obvious to people uninformed in these matters. In both, the muzzle is elongated for cropping herbage, in both, the habitus of living in open grass lands, and carrying the head lowered for grazing and elevated for gazing, has led to similar modifications. In both, the teeth are specialised in the same direction. In both, the socket for the eye is separated from the space occupied by the muscles of mastication by a bar of bone—the post-orbital bar. This bar of bone adds greatly to the general likeness between the two skulls. But if we look below the surface and examine the post-orbital bar with attention, we see that it is formed from very different anatomical elements in the two animals. In the cow, a process of the frontal meets a process of the jugal to form the post-orbital bar. In the horse, a process of the frontal meets a process of the zygomatic temporal to form a bar similar in disposition, but different in anatomical constitution.

Here, then, is a case in which habitus has begot a functionally identical bar of bone in two animals; but the elements from which the bar has been made are different in the two cases. The result attained is the same in both cases; but the method of attaining it is very different. Neither form can be regarded as a derivation of the other. Both stocks independently produced a post-orbital bar, and the roughly similar appearance of this portion of the skull in the horse and the cow is the result of a convergent development.

By the study of this seemingly trivial matter of the arrangement of the bones in the post-orbital bar we may feel quite confident that all Ungulates are not derived from some such form as Hyrax—the coney whose dwelling is among the rocks—for Hyrax has a post-orbital bar on the same lines as that of the cow, and it, therefore, differs fundamentally from the type of the horse. We may be confident that the Perissodactyles and the Artiodactyles must be traced back to some far distant ancestor in which the post orbital bar was wanting or was rudimentary. They must have originated independently from some remote, primitive, monodelphian mammal. After attentively studying the post-orbital bar we may even be permitted to wonder if a cow is any more akin to a horse than it is to a bat!

The conclusions which we have come to by considering this simple anatomical feature might seem to some to be far-fetched, and built upon slender foundations; nevertheless, not only do they not lack the support of the paleontologists, but they do not go to half the lengths of the definite findings of modern paleontology. We are only urging that the Artiodactyles and the Perissodactyles had independent origin from a basal mammalian form, which form may equally have been ancestral to other, and very different, modern animal types. But paleontology not only confirms this, it is actually prepared to admit, not only that the horses and cows arose independently, but that the horses themselves, as finished products, had multiple origins from a common ancestral form. Dr. Smith Woodward has said:—"The most exhaustive modern researches leave no doubt that the gradual reduction of the foot to a single toe and the deepening of the teeth for effective grinding of hard food, with various correlated specialisations, occurred in several distinct groups of horses in different localities."† And, again, of the Artiodactyles, he says: "Among the camels, for instance, which seem to have accomplished the whole of their evolution in part of North America, the characteristic cushioned foot appears to have been produced more than once."

It is, therefore, obvious that the simple method we are attempting to employ has not produced conclusions that can be regarded as new, or startling, or unwarranted, when we deal with the Ungulates.

Nor in studying the horse and the cow have we exhausted the post-orbital bar, for the fronto-jugal and the fronto-temporal types are by no means the only possible combinations. Other mammals, and many reptiles, have made experiments in building a bar of bone behind the eye, and a mere summary of all the complexes of different elements constitutes a study in itself. If habitus demands the development of a bar of bone behind the orbit, this bar will be developed; but the conformation of that region of the skull, begot of heritage, may cause the bar of bone to be made of widely varying elements.

If we now attempt to apply the same type of investigation to the structure of Man, we shall find that, looking over the Primates as an Order, *Homo* is placed in rather mixed company. Embraced in the Order Primates are the Lemurs, the Tarsiers, the New World Monkeys, the Old World Monkeys and Apes, and Man. In attempting to analyse this large group—a group that has no absolute individual distinguishing character—we will start with the Lemurs.

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† Anniversary Address to the Geol. Soc., Lond., 1916, p, LXXI.

We must admit that, in many ways, they appear to fulfill very well the requirements we would picture as belonging to an ancestral, primitive, and undeveloped monkey. A host of structural similarities are to be noticed; but the Lemurs have their hall mark. From the Lemurs of the Eocene period to the living members of the phylum to-day, there has passed on a definite and distinctive lemurine brand; a brand which they originated and retained, and which the other members of the Primates do not share. The tympanic bone of the Lemurs takes no part in forming the external auditory meatus, but it is snared within the auditory bulla, and remains, as a delicate little ring of bone, encapsuled in a bony bubble on the base of the skull. Now this remarkable arrangement of the bulla and the tympanic bone, although present in Lemurs of the Eocene, and therefore an extremely early acquirement, is not a primitive, but a highly specialised feature. Moreover, in the embryo of the Lemur, the tympanic bone lies without the bulla in the normal way, its envelopment by the bulla is secondary. No other mammal, primitive or specialised, shows the lemurine plan of tympanic bone and bulla; and in all the rest of the Primates these elements are either in their primitive form, or some form readily derivable from it; the tympanic is never encapsuled in the bulla. Using the same method of argument as we have used before, and having regard to this point alone, we may feel confident that the monkeys, with the simple tympanic, could not have been derived from the lemurs with the highly and uniquely specialised tympanic.

We may feel confident that the monkey stem and the lemur stem must be traced back to some primitive mammalian form; and we must remember that the lemurs had already branched away on their own line in the Eocene period. Despite the laboured and quite ineffectual attempts of Dr. W. K. Gregory (op. cit. Notharctus, p. 220) to explain away the difficulty of the lemurine tympanic*, and despite the criticisms levelled at the present writer's contentions by certain human anatomists, he has no hesitation in reaffirming the thesis that, not only are the monkeys not derived from the lemurs, but their kinship to them is no more than is their kinship to any other stock derived directly from the very earliest mammalian forms. This, of course, is only a restatement of the contention of St. George Mivart†, made as long ago as 1873, that "it is in the highest degree improbable that the lemuroids and the apes took origin from any common root form not equally a progenitor of other Mammalian Orders; consequently, if genetic affinity is to be our standard, the Lemuroidea should rank as a separate Order."

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* It is to be noted that though Dr. Gregory is an advocate for the lemurine origin of the Anthropoidea he reproduces a phylogenetic diagram, after Matthew [“Origin and Evolution of the Human Dentition. Reprinted from the Journal of Dental Research, 1921, p. 215, fig. 345] which depicts the Notharctus-Lemur stem and the Anthropoidea-Tarsioid stem still separate in the Cretaceous. This is exactly the state of affairs that the present writer has so often advocated as being probable. If the Notharctus-Lemur stem does not meet the Anthropoidea-Tarsioid stem till below the mid Cretaceous it would seem that the American paleontologists are not widely separated from the present writer in their views, for the common parent in the lower Cretaceous might justly be termed "one of the very earliest mammalian forms" which was also probably "equally a progenitor of other Mammalian Orders." It is probable that Dr. Gregory and I are in agreement upon this point.

† Proc. Zool. Soc., Lond., 1873, p. 508.

In commenting upon my views, Professor Elliot Smith (Zoological Society Discussion, p. 472), has said: "It reveals a singular lack of logic to exclude the Lemurs from the Primates because they are not Tarsii. One does not deny the rank of Carnivora to dogs because they are not bears!" But the fallacy in this otherwise very telling summary lies in the fact that not only are the Lemurs not Tarsii, but, in the same factors in which they manifest they are not Tarsii, they manifest their difference from every other animal within the Order Primates. It is true one does not exclude dogs from the Carnivora because they are not bears; but if they differed from bears in some fundamental feature, and also differed, in the same feature, from every other member of the Order Carnivora their inclusion within the Order might be logically called in question.

We will, therefore, state our position clearly, with the simple assertion that, *the True Lemurs are not forms which are ancestral to the Monkeys, nor, if phylogeny is regarded as of more importance than mere superficial resemblance, are they rightly included within the Order Primates.*

Having thus dismissed the true Lemurs from the direct line of human ancestry we are left with the Tarsiers, the New World Monkeys, and the Old World Monkeys and Apes.

That the Tarsier is a primitive monkey has always been my contention, and this contention has been put forward after a study of the whole of its structure.

The Zoological Position and Affinities of Tarsius were discussed by the Zoological Society of London in 1919; and the published account of the discussion (Feb. 1920) contains many opinions expressed at the time, and some that were not so expressed.

Weighing up the whole of the opinions, I think it is fair to say, in the words in which Professor MacBride (in the published account of the discussion, p. 497), summed up the situation:—"That there was one point on which all the speakers were agreed, viz., that *Tarsius* was much more nearly allied to the higher Primates than it was to the Lemurs." That is the thesis which I have repeatedly attempted to uphold. But, guided merely by the contributions to the same discussion, we may go much further than this. We may say that there is a general agreement that the modern *Tarsius* is a "living fossil" (Smith Woodward), the sole living survivor of a group of animals which, following the example of Dr. W. K. Gregory, we may term "primitive Tarsioids." These Tarsioids were flourishing during the Eocene, and they comprised such forms as *Anaptomorphus, Tetonius, Absarokius, Uintanius, Omomys,* and *Hemiacodon,* in North America; and *Necrolemur, Pronycticebus, Pseudoloris,* and others in Europe. They were differentiated "probably at the close of the Cretaceous period" (Elliot Smith). These Tarsioids were ancestral to the Monkeys and Apes and Man. "At some time during the Eocene (and somewhere in differentiated from one of the Tarsioid groups" (Elliot Smith). And again, the same authority as- the neighbourhood of America), true Monkeys were serts that "*Parapithecus* retains sufficient of the primitive traits to establish the truth of the Tarsioid ancestry of the Apes, but it also provides evidence which can only be adequately explained on the supposition that the transformation of a Tarsioid into a primitive Ape must have occurred before the close of the Eocene. For in the lowest Oligocene the primitive Ape, *Parapithecus,* is found in association with *Propliopithecus,* which had developed far beyond the stage represented by the former, and become a real Anthropoid Ape."

So far, then, we have arrived at certain very definite conclusions, and we have arrived at this stage simply by quoting those who, opposed, what Gerrit Miller* terms, the "tarsian hypothesis" of human ancestry.

We may, therefore, sum up the position by saying that it is agreed that *the Tarsioids of the close of the Cretaceous period were the ancestors of the Monkeys and Apes; and that primitive Apes were developed from this stock before the close of the Eocene; primitive Anthropoid Apes being developed in the lowest Oligocene.*

Monkeys and Anthropoid Apes are living today. How do they stand in relation to Man?

The New World Monkeys (*Platyrhini*) differ in a great many anatomical features from the Old

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* Amer. Jour. Phys. Anthrop. Vol. III., No. 2, 1920, p. 220.

World Monkeys and Apes (*Catarrhini*). Many of these differences are by no means trivial. We may agree with Dr. Gregory that these differences "as a whole exclude the Platyrhini from the ancestry of the Old World series, so that the two series appear to be parallel and independent branches from a more primitive and more Tarsioid ancestral stock." This "Tarsioid ancestral stock" of the Eocene gave rise "at different times to both the New World and the Old World series"; and "their modern relative, *Tarsius*, possesses many clear marks of remote kinship, with both main divisions of the higher primates."

To me it seems a fair inference from these statements to postulate that *Tarsius represents the ancestral stock from which the New World Monkeys and the Old World Monkeys and Apes diverged; and that the New World Monkeys and the Old World Monkeys are parallel evolutions, showing many convergent likenesses towards each other.*

All authorities are agreed that Man's alliance is with the Old World series rather than with the Playrhini, and we may, therefore, rule the New World series out of the direct line of human ancestry. But, in doing this, we must note a very curious point. Sir Arthur Keith, using Tyson's method, determined that "120 human characters are held in common either with Old World Monkeys (53 characters), with New World Monkeys (60 characters), or with Lemurs (17 characters)." Here is a rather remarkable thing. Dealing with Monkeys alone, and excluding anthropoid Apes, Man has a greater number of characters in common with the

New World Monkeys, which are admittedly an Eocene offshoot from the Tarsioid stem, than he has with the Old World Monkeys, in whose section of the Primates all authorities place him. Even after making due allowances for the weaknesses, which we have previously noted as being inherent in the application of Tyson's method, this finding appears to me to be a highly suggestive one.

We are now left with the problem:—What is Man's relation to the Old World Monkeys and Apes?

We will treat this problem just as we treated that of the horse and the cow, remembering that we are dealing now with animals which are obviously very strikingly similar in a great many features.

Upon the side of the skull, behind the orbit, there is a meeting place of certain bones that help to form the brain case. This meeting place is known in human anatomy as the pterion. At the pterion, the alisphenoid meets the parietal bone in Man, and the temporal bone fails to meet the frontal; in the Monkeys and Apes (except, at times, in the Orang), the temporal bone meets the frontal, and the alisphenoid fails to meet the parietal. Inside the skull another interesting feature is demonstrated on the floor of the same region of the brain case. In the human skull the presphenoid bone, and the mesethmoid articulate together over a wide area. In the Monkeys and the Anthropoid Apes (again with the exception of the Orang) the mesethmoid is excluded from contact with the presphenoid by an ingrowth of the frontals between the two.

Now it is easy to say that these are minor features in skulls which are so generally alike—but we will bear in mind the case of the post-orbital bar.

We have a difference between the cranial architecture of Man and the Gorilla and Chimpanzee, which I am inclined to think outweighs the value of "the pendant breasts of old female chimpanzees and gorillas," which Dr. Gregory* thinks so "suggestive of human relationship." I imagine, also that it outweights the "convincingly human appearance of the pregnant female chimpanzee," which has so much appealed to the same authority.

The anterior part of the floor of the brain case of a Gorilla looks singularly like the same portion of a human skull; but always there is this great difference in detail—the frontal bones form part of the floor of the skull behind the mesethmoid in the Gorilla, whereas, in Man, the mesethmoid articulates with the presphenoid without the intervention of the frontals. If now we attempt to assess the phylogenetic significance of this feature, we find the story a comparatively simple one. The alisphenoid-parietal pterion, and the mesethmoid-prespenoid articulation, which are typical of Man, are typical of *Tarsius*, and of all primitive Mammals. The fronto-temporal pterion, and the fronto-presphenoid articulation, which are typical of all Old World Monkeys and Apes (with the variable exception of the Orang), are specialisations pecular to them alone.

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* Jour. Dent. Research, Vol. III., No. 1. Human Dentition, 1921, Part V., p. 95.

Now, judging solely from these two points (in the Zoological Society discussion on *Tarsius* twelve were instanced), we would feel justified in saying that *Homo* has retained the primitive condition of heritage, and the Old World series has departed from it by specialisations begot of habitus. *Homo,* in fact, retains the tarsioid heritage, and this tarsioid heritage has been modified by habitus in the remaining Catarrhyni. Just as our knowledge of the irreversible nature of structural evolution compels us to conceive it in the highest degree unlikely that the tympanic bone took up its specialised position, within the bulla, of the Lemurs; and then emerged again to its original primitive position, without the bulla, in the Tarsioids; so the same knowledge forbids us to believe that the primitive pterion, and the primitive anterior fossa of the Tarsioids assumed their specialised form in the Catarrhyni, and then again reverted to their original primitive state in *Homo.*

We may feel sure that the ancestral line of Homo branches off from the Tarsioid stem before the simian specialisations of the anterior fossa of the skull had taken place: in other words, before the existing Catarrhyni had specialised.

Dr. W. K. Gregory has attained a standard rather below that usually aimed at by scientific men, when he ranks me among "such scientists and others as are ashamed of their poor relations," on the ground that I have claimed that we are not descended from existing Catarrhyni. All who are engaged in scientific work are seekers after truth, and Dr. Gregory knows full well that I differ from him, mainly, in assigning a *lower* mammalian origin to Man than he does.

The Tarsioids, for reasons which have been amply discussed elsewhere*, may be regarded as the originators of the large-brained group of Mammals. Enlargement of the brain, and consequent enlargement of the brain case, has affected three main types within this group—the Platyrhini, Man, and the remainder of the Catarrhyni. The enlarged bony brain cases of all three types may be said to resemble each other in a general way; and yet, in details of architecture, they differ widely. The disturbances due to the enlargement of the brain case have effected various regions of the skull—but they have affected the anterior fossa most. In detail, the pterion of the three types shows marked differences.

The human stock was, apparently, the pioneer stock in this enlargement of the brain case, and it enlarged a skull with the typical, primitive, tarsioid alisphenoid-parietal, and mesethmo-sphenoidal articulations. The remaining members of the Anthropoidea underwent their cerebral, and cranial, enlargement after their skulls had become specialised in various simian directions. Meanwhile, one member of the tarsioid stock stood still—and today we have *Tarsius*, as Smith Woodward has said: "a living fossil."

The position may be summed up in the words in which I stated my contentions at the Zoological Soicety of London. "*Tarsius* appears to be a very primitive member of the Anthropoidea, in which early specialisation of vision and arboreal leaping activities, absorbed the phylogenetic development of the species. *Homo* appears also as an extremely primitive form, in which cerebral advances, and a lack of unequal physical specialisation, save that of bipedal progression, is the phylogenetic keynote. The Anthropoid Apes have departed more from the primitive mammalian type in definite "simian" specialisations—which specialisations become increasingly conspicuous in the "lower" members of the Order.

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* See Elliot Smith. Brit. Assn: Pres. Address, Sect. H., 1912. Wood Jones, Arboreal Man, Lond., 1916, etc.

It is probably well within the province of the anatomist to examine and assess anatomical details, and to declare that the human stock is exceedingly primitive, and that it does not originate from the Old World Monkeys, or Anthropoid Apes, since these animals are definitely specialised by "simian" characters from the Tarsioid type. But it is not within his province to assign a geological date to the point of departure, though it may be to attempt to fix a comparative anatomical landmark. Although, as Dr. Gregory puts it, the anatomical characters of the Orang "have never deceived competent students of the subject, who have always recognised that of the three modern giant apes the Orang is, in many respects, the farthest removed from Man," I conceive the Orang (which often preserves the primitive pterion and anterior fossa) to be the animal nearest to the point of departure of the simian from the pro-human stem. And I am inclined to hold this view all the more strongly since Dr. Gregory says: "It seems highly probable that the Orang line separated from the giant ape-man stock *before* its subdivision into chimpanzee, gorilla, and human lines." With the conclusions as to the early separation of the Orang I certainly agree. Strangely enough, there have been other incompetents, besides myself, who have been deceived by the Orang. St. George Mivart, Professors Rolleston and Marshall, in England; M. Gratiolet and other zoologists in France; and, in part, Schroeder Van der Kolk and W. Vrolik, of Amsterdam, have been so deceived. Perhaps, after all, Dr. W. L. H. Duckworth's statement†, that "the Orang-utan is the visible expression of Nature's scorn for those morphologists who ignore physiological considerations," may be the explanation of Dr. Gregory's attitude.

I fully realise that the Orang is less anthropoid; I am quite aware that it is less adapted for bipedal progression, and that it has a bewildering complexity of specialisations of its own—but of the existing giant apes I certainly conceive it to be the one which most nearly marks the simian point of departure from the Tarsioid-Human stem.

As an anatomist I shall also not attempt to define which fossil Primate may be said to be on the Human, and which on the simian line. Dr. Gregory expresses a profound contempt for those who appeal to the incompleteness of the paleontological record. Incompleteness is doubtless a comparative term; but, quoting from Dr. Gerrit Miller, our available material of fossil apes, "whose characters might be hoped to aid in solving the problem of Man's ancestry," consists in the following:—

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† Morphology and Anthropology, Cambridge, 1915, p. 154.

"*Anthropodus.*—Jugal; upper incissor.

"*Dryopithecus.*—Most of the teeth; maxilla, lower jaw.

"*Gripopithecus.*—Third upper molar.

"*Neopithecus.*—Third lower molar.

"*Paleopithecus.*—Palate and upper teeth (except incisors).

"*Paleosimia.*—Third upper molar.

"*Parapithecus.*—Mandible, with its teeth.

"*Pliopithecus.*—Mandible with its teeth; palate, and upper teeth.

"*Pliohylobates.*—Femur.

"*Proliopithecus.* Mandible with its teeth.

"*Sivapithecus.*—Two fragments of lower jaws, one containing three perfect cheek teeth, the other containing the canine and roots of two incisors, and one premolar; a few cheek teeth, among them the first and second upper molars set in a small piece of the maxilla."

The reader is left to assess the completeness or incompleteness of the record of the fossil Primates for himself.

It will be noticed how largely a small part of a jaw and a few teeth figure in this list; and teeth may be misleading even in the hands of the best paleontologists. I freely admit that, since teeth are so often the sole remains of long extinct animals, paleontologists are forced to place great reliance on the evidence to be derived from them and I admit that, when the evidence is properly sifted, and is derived from a sufficient knowledge, it has a high probability of soundness. Nevertheless, I repeat that it must not be regarded as infallible or final. I am tempted to return to this subject in the light of the recent announcement of Henry Fairfield Osborn, after collaboration with Drs. W. K. Gregory and W. D. Matthew, of the discovery of an exceedingly early fossil Anthropoid in America.*

This fossil animal was named "*Hesperopithecus haroldcooki.*" Not only was it named, but its complete form, both male and female, was figured as a whole page illustration in an English lay illustrated weekly paper; the illustration being used to adorn an article upon this early American humanoid by Professor Elliott Smith. The only evidence upon which this whole fabric was reared consisted in a single water-worn molar tooth; and whatever the ultimate nature of the tooth may prove to be, it is sufficiently open to question, for Dr. Smith Woodward† to make the suggestion that in reality it is the tooth of a pliocene bear!

Of these so-called reconstructions of human ancestors, I wrote in 1918: "I find no occupation less worthy of the science of anthropology than the not unfashionable business of modelling, painting, or drawing these nightmare pictures of imagination, and lending them in the process, an utterly false value of apparent reality." If it should ultimately be agreed that the tooth of "*Hesperopithecus haroldcooki*" in reality belongs to an Anthropoid, there is nothing to justify those grotesque and purely imaginary pictures of the man-ape and his wife; and if it should be ultimately agreed that it belongs to a bear, what then of the credit of the modern paleontological interpretation of dental characters?

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* Amer. Mus. Novit., No. 37, reprinted in Science Vol. 55, May, 1922 pp. 463-465.

† Nature, June 10, 1922, p. 750.

In 1918 I published a little pamphlet entitled "The Problem of Man's Ancestry." It was a small publication of only 48 pages, issued by the Society for Promoting Christian Knowledge. This little pamphlet has by now attained some distinction, for its contentions have been so thoroughly disproved, and its fallacies so thoroughly exposed, that I am tempted to think that its contents were not acceptable to many of my contemporaries. A very imposing literature has been piled about it; it has been buried beneath a wealth of words and illustrations; almost I dare to hope that some of these contributions, so splendid in the manner of their presentation and publication, will ultimately provide monuments for its perpetuation, rather than grave stones for its burial.

Indeed, there are signs for a more immediate acceptance. We may not have to wait till tombstones become memorials. In October, 1919, at the Zoological Society's discussion, Professor Elliot Smith ranged himself with those who rejected my views. On January 27th, 1920, he delivered a lecture in London, in the course of which he is reported as saying¶ : "Man represents the straight

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† See also Animal Life, and Human Progress, Edited by Prof. A Dendy, London, 1919 pp. 99-132.

¶ Lancet, London, 1920, p. 357.

line of development. It is the animals which have departed from this straight line, and for self preservation have developed specialised characters (e.g., the great strength of the Gorilla), who have failed in the race of supremacy.'' With this statement I am in cordial agreement.

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